

CLAIMS

- 5 1. A modulator for receiving a plurality of sub-channel signals that are sampled at a base-band sampling frequency and separated by a frequency spacing, and, for generating a composite signal, combining the plurality of sub-channel signals, that is sampled at a composite sampling frequency, comprising:
- an inverse discrete Fourier transform coupled to receive and transform the plurality of
- 10 sub-channel signals into a plurality of time domain signals;
- a multiple channel polyphase filter coupled to receive said plurality of time domain signals and output a plurality of filter signals, and
- a commutator operable to fractionally sample said plurality of filter signals at a rate defined by the ratio of said frequency spacing and a greatest common divisor
- 15 between said composite sampling rate and said frequency spacing.
2. The modulator in Claim 1, and wherein said commutator fractional sampling ratio is the decimation rate.
- 20 3. The modulator in Claim 1, further comprising a wireless modulator operable to mix the composite signal with a wireless carrier for wireless transmission.
4. The modulator in Claim 1, and wherein said transform, said filter, and said commutator are implemented with executable software on a processing means.
- 25

5. The modulator in Claim 4, and wherein said processing means is a digital signal processor.

6. A modulator for receiving a plurality of sub-channel signals that are sampled at a base-band sampling frequency and separated by a frequency spacing, and, for generating a composite signal, combining the plurality of sub-channel signals, that is sampled at a composite sampling frequency, comprising:

an inverse discrete Fourier transform coupled to receive and transform the plurality of sub-channel signals into a plurality of time domain signals, said transform resolution defined by the ratio of said composite sampling frequency and the greatest common divisor between said composite sampling frequency and said frequency spacing, and, said transform decimation rate defined by the ratio of said frequency spacing and a greatest common denominator between said composite sampling frequency and said frequency spacing;

a multiple channel polyphase filter coupled to receive said plurality of time domain signals and output a plurality of filter signals, said filter having an interpolation rate defined by a least common multiple between said base-band sampling frequency and said composite sample frequency divided by said base-band sampling frequency, said filter decimation rate defined as said filter interpolation rate times said base-band sample frequency and divided by said composite sampling frequency, and

a commutator operable to fractionally sample said plurality of filter signals at a rate defined by the ratio of said frequency spacing and a greatest common divisor between said composite sampling rate and said frequency spacing.

7. The modulator in Claim 6, and wherein said commutator sampling rate is said decimation rate.

8. The modulator in Claim 6, further comprising a wireless modulator operable to
5 mix the composite signal with a wireless carrier for wireless transmission.

9. The modulator in Claim 6, and wherein said transform, said filter, and said commutator are implemented with executable software on a processing means.

10 10. The modulator in Claim 9, and wherein said processing means is a digital signal processor.

11. A demodulator for receiving a composite signal that is a combination of a plurality of sub-channel signals and that is sampled at a composite sampling frequency, and, for
15 discriminating the plurality of sub-channel signals each at a base-band sampling frequency and separated by a frequency spacing, comprising:

a commutator operable to fractionally distribute said composite signal to a plurality of filter input signals at a rate defined by the ratio of said frequency spacing and a greatest common denominator between said composite sampling rate and said
20 frequency spacing;

a multiple channel polyphase filter having a plurality of filter inputs coupled to receive said plurality of filter input signals, said filter outputting a plurality of filter signals, and

a discrete Fourier transform coupled to receive and transform said plurality of filter
25 signals, and output the plurality of sub-channel signals.

12. The demodulator in Claim 11, and wherein said commutator sampling rate is said decimation rate.

5 13. The demodulator in Claim 11, further comprising a wireless demodulator operable to receive a wireless carrier signal and discriminate the composite signal therefrom for wireless reception.

10 14. The demodulator in Claim 11, and wherein said commutator, said filter, and said transform are implemented with executable software on a processing means.

15 15. The demodulator in Claim 14, and wherein said processing means is a digital signal processor.

16. A demodulator for receiving a composite signal that is a combination of a plurality of sub-channel signals and that is sampled at a composite sampling frequency, and, for discriminating the plurality of sub-channel signals each sampled at a base-band sampling frequency and separated by a frequency spacing, comprising:
a commutator operable to fractionally distribute said composite signal to a plurality of
20 filter input signals at a rate defined by the decimation rate of said transform;
a multiple channel polyphase filter having a plurality of filter inputs coupled to receive said plurality of filter input signals, said filter outputting a plurality of filter signals, and said filter having an decimation rate defined by a least common multiple between said base-band sampling frequency and said composite sample
25 frequency divided by said base-band sampling frequency, and said filter having

interpolation rate defined as said filter interpolation rate times said base-band sample frequency and divided by said composite sampling frequency, and
a discrete Fourier transform coupled to receive and transform said plurality of filter signals, and output the plurality of sub-channel signals, said transform resolution
5 defined by the ratio of said composite sampling frequency and the greatest common denominator between said composite sampling frequency and said frequency spacing, and, said transform decimation rate defined by the ratio of said frequency spacing and a greatest common denominator between said composite sampling frequency and said frequency spacing.

10 17. The demodulator in Claim 16, and wherein said commutator fractional samples at said interpolation rate.

15 18. The demodulator in Claim 16, further comprising a wireless demodulator operable to receive a wireless carrier signal and discriminate the composite signal therefrom for wireless reception.

19. The modulator in Claim 16, and wherein said commutator, said filter, and said transform are implemented with executable software on a processing means.

20 20. The demodulator in Claim 19, and wherein said processing means is a digital signal processor.

21. A method of modulating a plurality of sub-channel signals that are sampled at a base-band sampling frequency and separated by a frequency spacing, onto a composite signal that is sampled at a composite sampling frequency, comprising the steps of:

converting the plurality of sub-channel signals into a plurality of time domain signals by

5 performing an inverse Fourier transform that has a resolution defined by the ratio of the composite sampling frequency and the greatest common divisor between the composite sampling frequency and the frequency spacing, and, a decimation rate defined by the ratio of the frequency spacing and a greatest common divisor between the composite sampling frequency and the frequency spacing;

10 filtering said plurality of time domain signals using a multiple channel polyphase filter to produce a plurality of filter signals, the filter having an interpolation rate defined by a least common multiple between the base-band sampling frequency and the composite sample frequency divided by the base-band sampling frequency, the filter decimation rate defined as the filter interpolation rate times the base-band sample frequency and divided by the composite sampling frequency, and

15 fractionally sampling said plurality of filter signals at a rate defined by the ratio of the frequency spacing and a greatest common divisor between the composite sampling rate and the frequency spacing.

20 22. A method of demodulating a composite signal that is sampled at a composite sampling frequency into a plurality of sub-channel signals each sampled at a base-band sampling frequency and separated by a frequency spacing, comprising the steps of:

fractionally distributing the composite signal to a plurality of filter input signals at a rate defined by the ratio of the frequency spacing and a greatest common denominator between the composite sampling rate and the frequency spacing;

25

filtering said plurality of filter input signals using a multiple channel polyphase filter to
produce a plurality of filter signals, the filter having an decimation rate defined by
a least common multiple between the base-band sampling frequency and the
composite sample frequency divided by the frequency spacing, and the filter
5 having interpolation rate defined as the filter interpolation rate times the base-band
sample frequency and divided by the composite sampling frequency, and
transforming said plurality of filter signals, using a discrete Fourier transform, into the
plurality of sub-channel signals, said transform resolution defined by the ratio of
the composite sampling frequency and the greatest common denominator between
10 the composite sampling frequency and the frequency spacing, and, the transform
decimation rate defined by the ratio of the frequency spacing and a greatest
common denominator between the composite sampling frequency and the
frequency spacing.